ORIGINAL RESEARCH

Evaluation of a Nova Scotia Diabetes Assistance Program for People with Type 2 Diabetes

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ABSTRACT

OBJECTIVE: This study was intended to evaluate the impact of a province-wide Diabetes Assistance Program (financial and self-management support) in a representative sample of individuals with diabetes and unmet financial needs. The impact of the program was evaluated on individuals managed with insulin or oral antihyperglycemic agents alone and also on individuals with good, suboptimal or poor diabetes control.

METHODS: Participants were recruited from the entire population of individuals approved for the Nova Scotia Diabetes Assistance Program into this pre/post cohort study of people with type 1 or 2 diabetes. Participants were recruited by letter, and data were obtained via phone interview. Participants were assessed with regard to glycemic control, self-care and quality of life.

RESULTS: The Diabetes Assistance Program was unable to show a strong net benefit for the entire study sample, but there were significant findings when initial degree of glycemic control was considered, and to a lesser extent, method of control. The strongest positive impact was for those patients with poor control (glycated hemoglobin [A1C] >8.5%), who had significant improvements in glycemic control (absolute reduction in A1C of 0.9%), self-care and quality of life were observed. Minor positive effects were also demonstrated for those with suboptimal control. Those with good control demonstrated an increase in A1C.

CONCLUSION: This study demonstrates the value of providing support for those with poor glycemic control. Interestingly, those with good control did not benefit from support. These data suggest that efforts to support individuals with diabetes should be directed at those most likely to benefit.

KEYWORDS: diabetes support, financial assistance, self-management support

RÉSUMÉ

OBJECTIF : L'objet de l'étude était d'évaluer les effets d'un programme provincial d'aide aux personnes diabétiques (soutien financier et de l'autogestion) dans un échantillon représentatif composé de personnes diabétiques ayant des besoins financiers non satisfaits. Les effets du programme ont été évalués chez des personnes qui prenaient de l'insuline ou des antihyperglycémiants oraux seulement et chez qui la maîtrise du diabète était bonne, sous-optimale ou médiocre.

MÉTHODES : Les sujets de cette étude de cohortes pré/post sur des personnes atteintes de diabète de type 1 ou 2 ont été recrutés parmi toutes les personnes inscrites au programme d'aide aux personnes diabétiques de la Nouvelle-Écosse. On a procédé par envoi d'une lettre pour le recrutement et par entrevue téléphonique pour la collecte des données. Les facteurs évalués ont été le contrôle de la glycémie, les soins auto-administrés et la qualité de vie.

RÉSULTATS : On a constaté que le programme d'aide aux personnes diabétiques n'avait pas d'avantage net très marqué dans l'ensemble de l'échantillon étudié, mais les résultats étaient significatifs quand on tenait compte du degré initial de contrôle de la glycémie et, dans une moindre mesure, de la méthode de contrôle. Les effets positifs les plus marqués ont été observés chez les patients dont le contrôle de la glycémie était médiocre (taux d'hémoglobine glycosylée [HbA_{1c}] > 8,5 %) : chez elles, il y a eu des améliorations significatives du contrôle de la glycémie (réduction absolue de 0,9 % du taux d'HbA_{1c}), des soins auto-administrés et de la qualité de vie. Il y a aussi eu de légers effets positifs chez les personnes dont le contrôle de la glycémie était sous-optimal. Chez les personnes dont le contrôle de la glycémie était bon, le taux d'HbA_{1c} a augmenté.

CONCLUSION : Cette étude démontre l'utilité du soutien chez les personnes dont le contrôle de la glycémie est médiocre.

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Fait intéressant, le soutien n'a pas été utile quand le contrôle de la glycémie était bon. Ces données laissent entendre que le soutien des personnes diabétiques devrait s'adresser à celles qui sont les plus susceptibles d'en profiter.

MOTS CLÉS : soutien des personnes diabétiques, aide financière, soutien de l'autogestion

INTRODUCTION

Diabetes is a chronic disease that requires ongoing medical management (oral antihyperglycemic agents [OAAs] and/or insulin) and behavioural modification (healthy eating, physical activity and self-monitoring of blood glucose [SMBG]) for optimal glycemic control, but there are significant self-management and financial challenges associated with optimal management. For example, the Canadian Diabetes Association (CDA) estimates that medical costs for people with diabetes are 2 to 3 times higher than for people without diabetes (from $1 000 to $15 000 per year), primarily for medication and testing supplies (1). Those with financial limitations and unmet needs, as well as those who lack private insurance, are disadvantaged compared to those who are able to cover these extra costs. There is very little empirical research into the impact of providing diabetes supplies on patients' glycemic control, self-care and quality of life. A few studies have suggested that assistance programs might improve glycemic control, prevent worsening of control or improve self-care behaviour (2-6), but most of these studies examined a highly selective sample, such as those attending an academic medical clinic. Firmer conclusions could be drawn from a more representative sample of individuals needing financial support. As well, the impact of financial and self-management support in those differing in diabetes treatment method or degree of glycemic control is relevant to understand.

In recognition of the financial and self-management challenges that might mediate poor diabetes outcomes, the Nova Scotia Department of Health initiated the Diabetes Assistance Program for eligible Nova Scotians. In addition to financial assistance, the Diabetes Care Program of Nova Scotia (DCPNS) self-management committee created written materials for distribution to program participants. This study is a non-experimental pre/post evaluation of the impact of the Diabetes Assistance Program in a representative sample of program participants. The impact of the program on glycemic control, self-care and quality of life over the program's first year was evaluated.

The Diabetes Assistance Program provided diabetes supplies and self-management tools to facilitate diabetes self-care. Supplies consisted of insulin, OAAs, blood glucose testing strips, syringes, needles and lancets. Self-management tools were brochures focused on encouraging a healthy lifestyle by targeting healthy lifestyle choices, using SMBG results to support improved diabetes management, linking with healthcare resources as appropriate and taking medication/insulin as prescribed. Recent research has supported the value of providing self-management education via nontraditional media, such as the computer, telephone or mail-outs (7-9).

In recognition of the fact that different types of diabetes treatment make varying demands on people with diabetes, the impact of the Diabetes Assistance Program on people managed with lifestyle alone, OAAs only and insulin (with or without OAAs) was examined (10), as was the program's impact on individuals with poor glycemic control. It was hypothesized that participants would demonstrate improvements over time with respect to glycemic control, self-care behaviours and quality of life.

METHODS

Participants

The main inclusion criterion for this year-long evaluation study was that participants be approved to receive benefits from the Diabetes Assistance Program. Exclusion criteria included minimum Grade 8 education, age <65 years (those age ≥65 years and older were covered by a Seniors' Pharmacare Program), and ability to understand English.

Sample size determination

Sample size for measures of metabolic control (glycated hemoglobin [A1C]), SMBG frequency and quality of life was determined using data collected in previous research by the principal author (unpublished) involving approximately 330 individuals with type 1 or type 2 diabetes from across the province. Sample size for self-report measures of diabetes self-care was determined using a second data set derived from a program evaluation study of approximately 150 individuals at the principal author's centre (11,12). Standard deviations for the total samples were used as estimates of population variance; sensitivity was set to 0.3 for A1C and 0.25 for other measures, resulting in a range of estimated required sample sizes (95% CI) of 20 to 120, depending on the measure. Sample size was based on the higher estimate, adding approximately 20% to account for attrition. As the intent was to study 3 groups separately (i.e. those managed with lifestyle alone, OAAs alone and insulin with or without OAAs) recruitment was planned to obtain sufficient participants to apply the power analyses to the subsamples (i.e. 150 individuals per subsample, for a total of 450).

Self-management support materials

A multidisciplinary committee (2 individuals living with diabetes, Nova Scotia CDA representative, physician, diabetes educators (nurses and dietitians), pharmacists, psycholo-

gist, social worker) directed by the DCPNS provided content expertise for 4 self-management brochures (see Table 1). Materials were developed using a self-management focus. The materials were designed to encourage action and were reviewed by the primary investigator (a health psychologist) to ensure that principles of motivational enhancement were incorporated. Two community-based focus groups of individuals living with diabetes provided detailed feedback on the draft content of the brochures.

Procedure

When participants applied for the Diabetes Assistance Program, they received a permission-to-contact form as part of their application materials (see flow diagram, Figure 1). This form explained the study and requested contact information and permission to be contacted for enrolment. Enrolment and consent occurred via telephone with written consent being obtained after the fact by mail. Pre-scheduled telephone interviews lasted an average of 20 to 30 minutes, during which basic demographic information was obtained on sex, age, duration of diabetes, method of treatment and study variables. One year following enrolment, the same individuals were contacted again by phone to obtain follow-up data. This protocol was approved by the Research Ethics Board of the Capital District Health Authority, Halifax.

Data analysis

Data were analyzed using repeated-measures analyses of variance. For each dependent variable, a split-plot analysis of variance was calculated, with 2 between-subject factors (treatment type: OAAs alone vs. insulin with or without OAAs; and degree of glycemic control: good, suboptimal or poor) and 1 within-subject factor (time: entry and one year follow up).

Outcome measures

Glycemic control

The impact of the program on glycemic control was evaluated by obtaining participants' permission to contact their family doctor to obtain their most recent A1C value.

Self-care

Participants completed a series of self-report instruments regarding regimen adherence and healthy eating. Specifically, participants reported the number of days they performed SMBG; average frequency of testing per day on the days they test; familiarity with diabetes management and medication principles; frequency of missing medication/insulin; frequency of raising diabetes as a topic during medical visits; frequency of eating 3 meals per day; and extent to which participants considered themselves to have a "sweet tooth." These self-report measures were developed and validated by the study group.

Quality of life

Quality of life was assessed using the short form of the Diabetes Care and Complications Trial Quality of Life Scale (DQOL-SF) (13), the short form of the SF-36 (SF-12) (14) and the short form of the Mental Health Inventory (MHI-5) (15).

RESULTS

Sample recruited

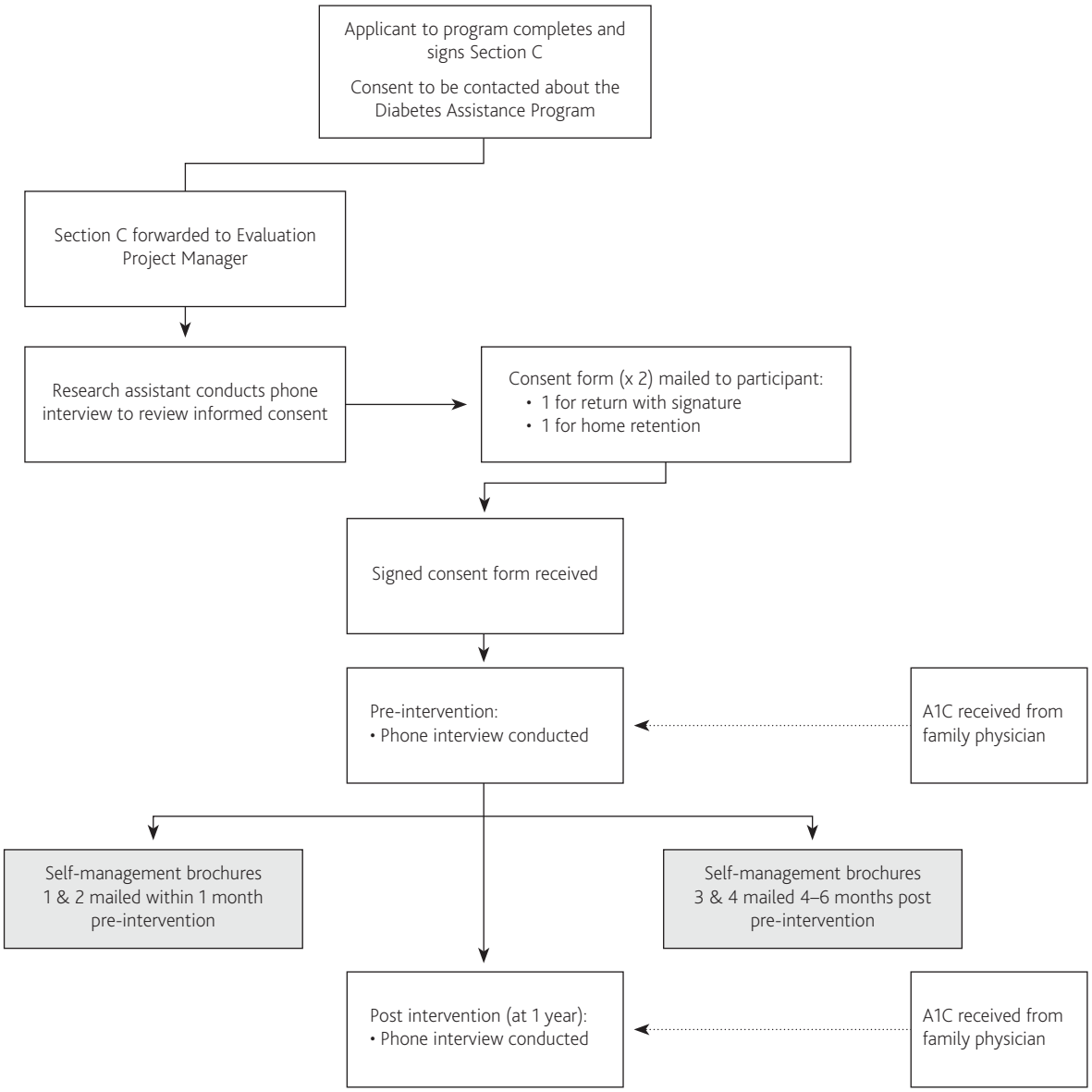
The initial intent was to enrol 150 individuals from each of 3 groups: insulin use (with or without OAAs), OAAs use alone and those managed with lifestyle alone. However, this strategy was altered for 2 reasons. First, it proved impossible to recruit an adequate sample of individuals managed with lifestyle alone; of the first 250 eligible participants, only 6 fell into this category. Second, the Nova Scotia government announced a new Family Pharmacare program that would render the Diabetes Assistance Program obsolete shortly after its launch. Given these factors, it was decided to recruit as many participants as possible within the time frame allowable (June 2006 to June 2007). At the end of the recruitment period, only 15 participants managed their diabetes by lifestyle alone; as a result, the lifestyle only group was eliminated from the analyses.

The sample recruited is described in Table 2. More females were recruited than males, but the proportion of females and males was the same for both treatment groups.

Table 1. Self-management brochures provided to Diabetes Financial and Self Management Support Program participants

Brochure 1	*Healthy Living and Self-Care: Living with Diabetes* contained tips for healthy living, including eating well, engaging in physical activity, managing stress and self-care (e.g. how often to see the doctor; what tests to have and how often; diabetes management; and where to go to learn more about diabetes).
Brochure 2	*You and Your Blood Sugars: Testing for Better Health* discussed why persons with diabetes should test their blood glucose; when to test; causes of highs and lows; usual target blood glucose values; and tips for appropriate use of meter, lancets and strips.
Brochure 3	*Staying Well with Diabetes: Using Health and Community Supports* contained information on the diabetes healthcare team and how best to interact with team members and healthcare providers. There are tips on preparing for appointments and descriptions of diabetes tests and their usual target values. There was also important information regarding family/friends and community supports and how to access them.
Brochure 4	*Making the Most of Your Medications* discussed the importance of diabetes medications (why take them); the way medication use may change over time for a person with diabetes; and how physicians decide when and if to change a person's medications. There were also tips for using medications and working with a pharmacist.

Figure 1. Flow diagram of study procedure



Participants were, on average, in their 50s, although those using insulin were younger. Those using insulin had also had diabetes for significantly longer than those managed with medication only, were more likely to have type 1 diabetes and had poorer glycemic control. The majority of participants from both groups had less than high school education; there was no difference between the groups in distribution of education level.

To evaluate the impact of the Diabetes Assistance Program on participants with varying levels of glycemic control, the overall sample was divided into three control-related categories: good (A1C <7.0%), suboptimal (A1C 7.0 to 8.5%) and poor (A1C >8.5%). Data on A1C levels reported by a family physician were available for 93.7% of the sample. There was an even distribution of degree of control across the sample at enrolment: 34.0% good, 33.7% suboptimal and 32.3% with poor control.

Outcomes

Glycemic control

Analysis of A1C yielded significant effects for insulin/OAAs ($F=6.432$, $p=0.013$) and degree of pre-program control ($F=148.142$, $p<0.0001$), as well as a pre-program control by time interaction ($F=23.776$, $p<0.001$). Overall, those using insulin had poorer control (7.96% vs. 7.67% for those on OAAs only) and, by definition, those with good control had lower A1C (6.67%) than those with suboptimal or poor control (7.6 and 9.18%, respectively). The degree

Table 2. Study sample

	Insulin (alone or with OAA) (n=176)	*OAAs (n=175)*	*Group difference (p)*
Sex Male Female	 34.7 65.3	 35.4 64.6	NS
Age, years (SD)	53.7 (10.3)	56.9 (7.2)	0.001
Duration of diabetes, years (SD)	16.4 (10.9)	8.6 (7.5)	<0.001
Education < High school High school College or greater	 60.0 31.0 9.0	 54.5 30.1 15.4	NS
Diabetes type Type 1 Type 2 Unknown	 30.2 58.7 11.0	 — 91.9 8.1	<0.001
Glycemic control at enrolment <7.0% 7.0–8.4% >8.5%	 23.2 33.9 42.9	 45.3 33.5 21.1	<0.001

All values are %, unless otherwise indicated

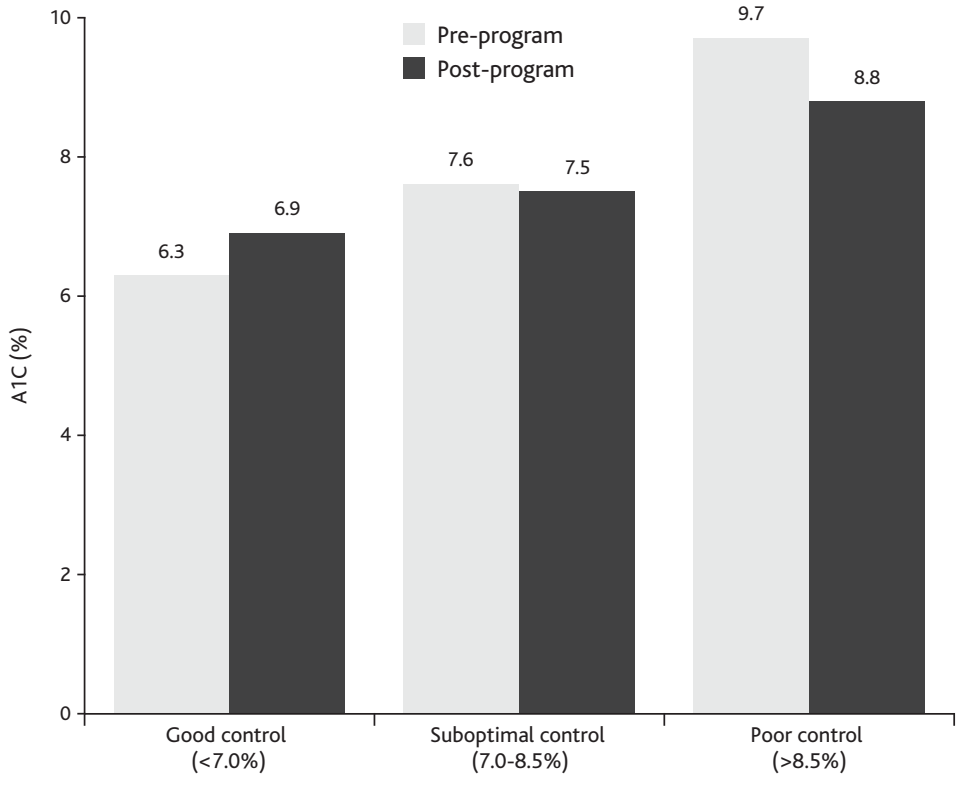
OAA = oral antihyperglycemic agent

of pre-program control by time interaction is shown in Figure 2. Over the year of the study, A1C became significantly worse for those with good control at entry (increased by 0.73% for those taking insulin and 0.61% for those on OAAs only); did not change for those with suboptimal control (increased by 0.06% for those on insulin, decreased by 0.06% for those on OAAs only); and significantly improved for those with poor control (decreased by 0.68% for those on insulin and 1.12% for those on OAAs only).

Self-care outcomes

Frequency of SMBG was assessed by self-report of the number of days per week testing was done (coded 1 for 1 to 2 days per week; 2 for 3 to 4 days per week; 3 for 5 to 6 days per week and 4 for daily) and by self-report of the average number of times testing on the days testing occured (from 1 to 4). Overall, those on insulin tested more days than those on OAAs only (3.70 vs 2.93, respectively; F=51.45, p<0.001). Frequency of days tested increased from enrolment to 1 year, but differentially based on level of control and method of management. Frequency of SMBG increased for those on OAAs only (2.83 to 3.03), but not for those on insulin (3.74 to 3.66; F=3.99, p=0.047). As well, only those with poor control at entry demonstrated an increase in SMBG (3.07 to 3.37) relative to those with

Figure 2. Glycemic control over the first year of the Diabetes Assistance Program



A1C = glycated hemoglobin

suboptimal control (3.36 to 3.39) or good control (3.42 to 3.27) (F=3.35, p=0.037). The number of tests per day did not change over time for any group (all Fs NS) and did not differ by degree of control (NS). Those on insulin tested more times per day (2.65) than those on OAAs only (1.85; F=50.55, p<0.001).

On ratings of the degree to which participants understood the medications they were taking, analyses indicated that level of understanding increased from enrolment (5.62) to 1 year (5.89), a change that was not affected by initial degree of control or medication type (F=6.94, p=0.009). Overall, however, those on insulin reported a greater understanding of their medication compared to those on OAAs alone (6.04 vs. 5.47; F=10.93, p<0.001). When asked about the frequency with which medications were missed, ratings were generally low (1.8 at entry, 1.7 at 1 year) and did not change over time (F=0.78, NS). However, those in poor control reported missing medication more often (2.01) relative to those with suboptimal or good control (1.60 and 1.67, respectively; F=3.74, p=0.025).

Participants were asked to rate their understanding of the principles of diabetes management using a 7-point scale, specifically in regards to diabetes itself; medication; use of SMBG; preventing highs, lows and complications; and the benefits of improving glucose control and self-care. Ratings were averaged to yield a measure of overall understanding of the principles of diabetes self-management. In general, there was an increase in understanding from enrolment to 1 year (5.72 to 5.95, F=23.21, p<0.001); those on insulin reported higher levels of understanding than those on OAAs only (6.0 vs. 5.67; F=9.85, p=0.002). The increase in understanding over the year of the program was not influenced by initial degree of control (F=2.28, NS) or type of management (F=0.90, NS).

Participants also used 7-point scales to rate the extent to which they agreed that the best possible self-care would delay or prevent complications (5 questions). Average ratings were high both at entry and 1 year. There were no differences in average ratings over time or between those with different levels of control or type of treatment (all Fs NS).

Participants also responded to 6 questions about the frequency with which they discussed various aspects of diabetes care with their family physician. The average frequency rating increased from entry to the 1 year assessment (4.28 to 4.61; F=18.53, p<0.001). Frequency of discussing diabetes with the family physician was not influenced by degree of control (F=0.56, NS), but it was higher for those on insulin than those taking OAAs only (4.67 vs. 4.22; F=7.24, p=0.008).

The frequency of self-report of eating 3 meals per day did not change over time (F=0.088, NS), but was greater for those on insulin than for those on OAAs alone (6.35 vs. 5.78; F=8.46, p=0.004); it was also greater for those with good (6.24) or suboptimal control (6.31) than those with poor control (5.65; F=4.21, p=0.016).

Participants were also asked to rate the extent to which they were an emotional eater or had a "sweet tooth." This data was collected because cravings have been shown to be important factors influencing self-care and control. There were no differences in the extent to which participants considered themselves to be emotional eaters (average rating 3.60), either over time or between groups (all Fs NS). The only difference was that those on insulin rated the extent to which they had a "sweet tooth" lower than those on OAAs alone (4.01 vs. 4.68; F=5.12, p=0.024).

Quality of life outcomes

On the SF-12 physical health subscale, there were no changes in physical functioning over time (F=2.59, p=0.109), and no differences based on degree of control (F=0.04, NS) or treatment type (F=0.09, NS). As well, there were no interactions between treatment type, degree of control and time (all Fs NS). On the SF-12 mental health subscale, scores increased from enrolment to 1 year (29.90 to 32.54, F=9.17, p=0.003). Overall, mental health scores did not differ based on degree of control (F=0.2, NS) or treatment type (F=0.31, NS), but the interaction between degree of initial control and change over time was just at significance level (F=2.94, p=0.055). Those with poor control showed the greatest improvement in mental health scores (28.44 to 33.79) compared to those with suboptimal (30.44 to 33.05) or good control (30.83 to 30.79).

There were no changes in diabetes-specific quality of life (DQOL-SF) from enrolment to 1 year (3.13 vs. 3.14; F=0.27, NS), and no difference between those on insulin and those on OAAs only (3.15 vs. 3.13; F=0.24, NS). However, there was a difference based on degree of control, those with poor control reported a lower quality of life (3.09) relative to those with suboptimal or good control (3.11 and 3.22, respectively; F=3.68, p=0.026). None of the interactions in this analysis were significant.

Finally, there were no significant differences over time with respect to general psychological well-being (the MHI-5), or related to degree of control or type of treatment, and there were no interactions between these factors (all Fs NS).

Post-hoc analyses

Although not part of the main hypotheses, data were collected concerning participants' evaluation of the self-management materials. At the 1 year evaluation, participants were asked 3 open-ended questions; verbatim responses were recorded and coded. For the first question (What did you think of the self-management materials?), responses were coded as *negative, don't recall, neutral, positive* and *did not receive*. For the second question (Did you learn anything new from the

self-management materials?), responses were coded as *no, not really, yes (but unspecified)* or *yes (specified)*. For the third question (Did the self-management materials help you with diabetes management?), responses were coded as *did not help in management* or *positive, helpful*.

Almost all participants (96.8%) answered the first question, but only 49.2% answered the second and 45.4% answered the third. In terms of overall judgment of the self-management materials, only 0.6% reported a negative reaction, but 33.7% reported they either did not receive or could not recall the material. Few (6%) reported a neutral response to the self-management material, and 48.3% reported a positive response. Of those who responded to the second and third questions, most (60.7%) stated they did not learn anything new, but nonetheless found the materials helpful (86.4%). The distribution of these responses was not influenced by method of treatment (all χ^2 NS). As well, there was no relationship between response to self-management materials, type of treatment and change in glycemic control (all Fs NS).

One other issue was addressed in a post-hoc manner. Specifically, we were interested in understanding the role of sex in the program. Sex was not associated with glycemic control, either in terms of overall differences between men and women, or in response to financial and self-management support (all Fs ns).

There was no sex-specific impact of financial and self-management support on any measure of quality of life (SF-12, DQOL or MHI); that is, sex was not associated with change in quality of life over time. However, women reported lower quality of life than men overall on the SF-12 mental health subscale ($F=14.52$, $p<0.001$) and the MHI ($F=14.87$, $p<0.001$). No sex differences were found on the SF-12 physical health subscale or the diabetes-specific quality of life measure (Fs NS).

Regarding self-care, there were sex differences with respect to SMBG. First, there was an interaction between degree of control and sex regarding the number of days per week SMBG was performed ($F=3.64$, $p=0.033$). The frequency of SMBG did not change over time or differ between sexes for those with good or suboptimal control. However, for those with poor control, men but not women reported increasing SMBG frequency over time. With respect to the frequency of testing on days when tests were completed, women reported testing more often than men overall ($F=4.22$, $p=0.05$).

Sex was also associated with a change in understanding of medications: men but not women reported an improved understanding of their medication over time ($F=9.91$, $p=0.005$; women reported higher levels of understanding at entry and stayed at the same level). Finally, women reported higher levels of emotional eating than men ($F=17.23$, $p<0.001$). No other sex differences were found.

DISCUSSION

Type 2 diabetes is taking an enormous toll on the lives of those living in industrialized societies and methods to improve glycemic control have the potential to greatly reduce this toll, both for the individual, the healthcare system and society in general (16). Efforts to improve glycemic control have been assisted by the development of new medications and self-management tools, but these cost money, and financial barriers can severely limit the ability of an individual to engage in and sustain self-care behaviours (1).

In recognition of these financial and self-management challenges, the Nova Scotia government decided to provide support to those with diabetes and unmet financial needs. Although this program has since been transformed so that it now covers more than just diabetes supplies (Family Pharmacare), the Diabetes Assistance Program was operating long enough for us to conduct an evaluation of its impact.

In light of the fact that the provincial department of health was not prepared to support a randomized evaluation of the Diabetes Assistance Program, a systematic evaluation of the impact of the program was worthwhile, even if causality could not be addressed. As it turned out, the Diabetes Assistance Program was a finite project, eventually replaced by another system. Therefore, the overall population of individuals who received Diabetes Assistance Program benefits can be described. A total of 2579 Nova Scotians were approved for benefits totalling $7 034 829, of which $5 141 833 were claimed. Recipients were, on average, 52.8 years of age and 55.6% were female. Given the sample recruited, it appears that females were more likely to volunteer for our study, as our female population was approximately 65%.

In terms of our overall hypotheses, collapsing across groups based on initial degree of control, few significant findings resulted. Overall, A1C did not change from enrolment to 1 year. In terms of self-care, there was an overall increase in self-reported understanding of the principles of diabetes management; understanding of medications for glycemic control; and frequency with which individuals discussed diabetes with their physician. There was no change in self-reported SMBG frequency or medication adherence. There were no changes in quality of life for the group as a whole.

This overall negative finding is somewhat deceptive, however, because the Diabetes Assessment Program interacted significantly with degree of glycemic control and, to a lesser extent, type of treatment. The program was found to have a significant positive impact on those with poor initial control (>8.5%), who demonstrated an absolute A1C reduction of 0.9% over 1 year—a reduction that was both clinically and statistically significant. Further, these individuals reported an increased understanding of the principles of diabetes management and their medications, a greater frequency of discussing diabetes with their physician and a significant

increase in number of days per week they performed SMBG. These individuals also reported an increase in non–disease-specific quality of life (SF-12 mental health score). Finally, men with poor control reported an increase in SMBG frequency over the evaluation period.

In contrast to those with poor control, the program had little impact on those with suboptimal control at enrolment. These participants demonstrated only an increase in understanding of diabetes and medications, increased frequency of discussing diabetes with their physician and a trend toward improved non–disease-specific quality of life (SF-12 mental health score).

Finally, the program did not appear to have an impact on those with good control at enrolment. The only positive change for these participants was a nonspecific increase in understanding of diabetes management and medication, as well as an increased frequency of discussing diabetes with their physician. Surprisingly, this group demonstrated a significant increase in A1C of 0.58% over the duration of the program.

These data suggest that degree of glycemic control is an important moderating factor for support programs such as the Diabetes Assistance Program, and that those with poor control are the most likely to benefit. Apart from response to the program, these individuals distinguished themselves from those with suboptimal or good control in a number of ways: they reported missing their medication/insulin more often and were less likely to eat 3 meals per day. They also reported lower disease-specific quality of life. Those with poor control appear to be a specific group who are compromised not only in their glycemic control, but also in their self-care and quality of life. These data support the notion that resources should be devoted to those most in need of help. This study also adds data to suggest that providing financial support to this vulnerable group will improve glycemic control, self-care and quality of life.

This study also found some interesting differences based on type of treatment. First, those on OAAs only reported an increase in frequency of SMBG over the evaluation period. This finding is qualified by the fact that those on insulin performed SMBG more often overall. The increase in testing frequency for those on OAAs was significant, but by the end of the study those on OAAs only were not testing as frequently as those on insulin. Further, those on OAAs only had better glycemic control overall than those on insulin (7.67 vs. 7.97%), but those on insulin reported higher levels of understanding of diabetes management and medication principles, greater frequency of discussing diabetes with their physician, greater frequency of eating 3 meals per day and lower ratings of having a "sweet tooth."

A post-hoc analysis revealed few differences between men and women. Women appeared to be more challenged regarding quality of life and emotional eating. Men appeared to have benefited more with respect to increased SMBG for those in poor control and increased understanding of the role of medications. This study was not designed to assess sex differences, but the observations uncovered justify a more detailed examination into the role of sex in self-management support.

This study contributes to our understanding of how to help individuals with type 2 diabetes manage their disease. Other studies have also suggested that providing financial support is beneficial; however, this is the first to examine the impact based on degree of glycemic control. Strum and colleagues (3) studied a medical assistance program on a relatively small sample of individuals in a specific diabetes practice; our study sampled from all Nova Scotians who enrolled in the Diabetes Assistance Program. As this turned out to be a finite program, we were able to calculate the proportion of participants who enrolled in our study. While we oversampled female participants, our sample represents 13.61% of the entire population of Nova Scotians enrolled in the Diabetes Assistance Program. Nyomba and colleagues (4) randomized a small group of insulin-requiring people with type 1 and 2 diabetes to receive free blood glucose test strips or none. Over the short term, they found an increase in frequency of SMBG in those given free strips and a stabilization in A1C across the 1 year evaluation period, in contrast to an increase in A1C in the control group. Our study demonstrated, for those with poor glycemic control, that A1C actually decreased over the 1 year evaluation period. Interestingly, those with good control, who did not benefit from the Diabetes Assistance Program, showed a significant rise in A1C levels. Horswell and colleagues (17) was able to tie the degree of benefit of medication assistance programs to adherence, as measured by prescription refills. They reported a linear association between increased adherence and lower A1C values. This study, like ours, took the approach of identifying patient subgroups rather than analyzing all patients as a single group.

Lack of a control group, particularly a randomized control, is a limitation of this study and raises the possibility that findings might reflect regression to the mean. While this threat to internal validity cannot be neutralized by the study design, a number of facts suggest regression to the mean is not in play. First, A1C is seen as a stable, gold-standard measure of glycemic control. A reduction of 0.9% is clinically significant and reflects substantial improvement in glucose metabolism. Regression to the mean would imply that the change from pre- to post-program is only a statistical phenomenon, but this is not consistent with how A1C is seen in the field. Second, the improvements noted in the poor-control group was reflected not only in A1C but also in self-care and quality of life measures, despite

the fact that group categorization was based solely on A1C. If the results were simply due to a statistical artifact, then improvements in self-care and psychological functioning would not be expected.

In conclusion, this study suggests there is an important role of providing financial and accessible self-management support to those with diabetes and poor control. It appears as though supporting these individuals has benefits in regard to glycemic control, self-care and quality of life.

ACKNOWLEDGEMENTS

The authors acknowledge and thank Christine Borgel, Pamela Gray and Karen Norris, who were instrumental in carrying out this research. We would also like to thank Igor Grahovac and Zlatko Karlovic for database development and web support. We also express our appreciation for the contributions of the healthcare professionals (DCPNS self-management committee members), who assisted with the development of the self-care materials, and individuals living with diabetes, who gave their time and experience to this research (through committee and focus group contributions) and as study participants. Finally, we would also like to acknowledge Lynn Edwards, Dawn Frail and Emily Sommers for their role in providing guidance for this research.

AUTHOR DISCLOSURES

This study was funded by the Nova Scotia Department of Health, with funds administered by the Diabetes Care Program of Nova Scotia.

AUTHOR CONTRIBUTIONS

All authors were involved in the study design, running the study, and data interpretation. MV took responsibility for design, analysis and writing, with the assistance of PD. LT and AN took primary responsibility for collecting data and managing the database.

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